REMARKS

New claims 81-101 being added by this amendment are substantial copies of or are for substantially the same subject matter as claims 1, 2, 8, 10-14, 16, 17, 19, 26-28, 31, 35, 38-42 of U.S. Patent Application Publication No. US 2002/0018217, published February 14, 2002, Application Serial No. 09/927,102, filed August 10, 2001, a copy of which is attached hereto. A prompt examination and allowance of the claims presently pending in this application is respectfully requested.

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

81. (New) A wafer measurement system for use within a wafer process tool, comprising:

a wafer measurement station forming one of the stations of the wafer process tool, the measurement station having a wafer support, the measurement station also having therein an optical measurement system forming a scatterometry instrument that is moveable by a stage to specified locations over the wafer support, the optical measurement system optically coupled to a light source to direct a light beam as a spot onto patterned features on a wafer surface on the wafer support, the head also having a light collector associated with a detector whereby illuminated features on the wafer yield characteristic optical signatures with independent optical parameters in the signatures; and

a data processor analyzing the characteristic signatures of a wafer using a scattering model for possible periodic structures on a wafer to obtain a measure of the patterned features on the wafer so that a process carried out by the wafer process tool can be analyzed.

82. (New) The apparatus of claim 81 wherein the optical measurement system includes an objective lens imaging light from a spot on the wafer.

83. (New) The apparatus of claim 81 wherein the light beam incident on the wafer is substantially unpolarized.

84. (New) The apparatus of claim 81 wherein the optical measurement head directs the light beam at normal incidence onto the wafer surface.

85. (New) The apparatus of claim 81 wherein the measure of patterned features obtained by the data processor includes at least one dimension of lateral or vertical geometric structure of features on the wafer.

86. (New) The apparatus of claim 85 wherein the measure of patterned features include line width and profile of features on the wafer.

87. (New) The apparatus of claim 86 wherein the profile of pattern features is characterized by a feature height or depth that may be variable with lateral position across the features, the scattering model used by the data processor taking such variable feature height or depth dependence on lateral position into account.

88. (New) The apparatus of claim 81 wherein the measure of patterned features obtained by the data processor includes film thickness.

89. (New) The apparatus of claim 81 further comprising a stage driving the optical measurement system.

90. (New) The apparatus of claim 81 wherein the wafer support is capable of moving a wafer in at least one dimension.

91. (New) The apparatus of claim 90 wherein the wafer support provides (x,y) translation of a wafer.

92. (New) A scatterometry instrument integrated within a wafer measurement station that forms one station of wafer process tool, the wafer measurement station having a spectrometry instrument and a wafer support with a capacity for locating a wafer at a measurement position, wherein the scatterometry instrument comprises:

a movable stage;

an optical measurement system mounted on said stage for movement by said stage to one or more specified locations over a wafer held by a wafer support in the measurement position, the measurement system being in optical communication with a light source for directing a light beam as a spot onto patterned features on a wafer on the wafer support, the measurement system having collection optics associated with a detector for collecting and detecting light scattered from the portion of the wafer illuminated by the light beam, whereby features on the wafer yield characteristic optical signatures with independent optical parameters of the signatures; and

a data processor in communication with the detector, the data processor analyzing the characteristic optical signatures using a scattering model for possible periodic

structures on a wafer to obtain a measure of the patterned features on the wafer such that a process carried out by the wafer process tool can be analyzed.

93. (New) The instrument of claim 92 wherein the optical measurement system directs the light beam at normal incidence onto the wafer.

94. (New) The instrument of claim 92 wherein the collection optics of the measurement system includes an objective lens positioned to image light scattered from a spot on the wafer.

95. (New) The instrument of claim 92 wherein the light source is optically coupled to the optical measurement system via an optical fiber.

96. (New) The instrument of claim 92 wherein the light beam incident on the wafer is substantially unpolarized.

97. (New) The instrument of claim 92 wherein a measure of patterned features obtained by the data processor includes at least one dimension of lateral or vertical geometric structure of features on the wafer.

98. (New) The instrument of claim 97 wherein the measure of patterned features include line width and profile of features on the wafer.

99. (New) A wafer measurement method for cooperative use with a wafer process tool, comprising:

within the wafer process tool after completion of a process step carried out in processing stations of the process tool, receiving in an integrated measuring station of the process tool a waferin the measurement station relative to a moveable optical measurement system;

moving an optical measurement system to a plurality of locations over the wafer;

directing a beam of light normally onto the wafer surface as a light spot at each of said plurality of locations;

detecting light reflected from the wafer surface to obtain data for an optical characteristic of surface pattern features on the wafer at said plurality of locations; and

analyzing the optical characteristic data using a scattering model of possible periodic structures on a wafer to obtain a measure of critical dimensions of the surface pattern features on the wafer.

100. (New) The method of claim 99 further defined by sequentially measuring reflectance data for a plurality wafers received from the wafer process tool.

101. (New) A method of measuring a wafer within a wafer process tool, comprising:

transferring a wafer from a process station of the process tool to a measurement station of the process tool;

positioning a measurement spot of an optical head of a measurement instrument within the measurement station over a first location of the wafer;

rotating the wafer and translating the optical head to position the measurement spot over a second location of the wafer;

repeating the wafer rotation and optical head translation to successively position the measurement spot over different locations of the wafer; and

measuring an optical characteristic of the wafer at each of the successive measurement locations.